CONSTRUCTION STANDARD SPECIFICATION

SECTION 15S

PIPING - STEAM PLANT

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15S-01 SCOPE

A. Included: Materials and operations required for the installation of interior piping systems, including all steam, condensate, feedwater, water column drain, chemical feed, economizer vent, economizer drain, safety valve outlets, purifier drain, continuous blow-off, mud drums blow-off, natural gas, fuel oil, boiler drum vent steam sampling, boiler feedwater crosstie piping, and L.P. - gas piping, fittings, valves, equipment, joints and tests, so that modifications and additions shall be equivalent to the existing piping systems.

15S-02 CODE REQUIREMENTS

A. ASME Boiler and Pressure Vessel Code, Section I, Power Boilers. The latest edition of this code covers the materials, application, fabrication and erection of the following piping:

1. Steam pipe including all pipe from the boiler nozzle, including the automatic non-return valve and through the second, O, S & Y stop valve at the header.

2. Boiler Feedwater piping from the boiler drum, the stop and check valve, including the economizer if so equipped, and to the inlet to the feedwater regulating valve and by pass valve if used.

3. Blow off piping connected to any boiler outlet from the boiler connection through the second stop valve.

4. Miscellaneous piping including continuous blowdown, water column drains, gauge glasses, etc. up to and including the first shut off valve.

B. The American National Standard Code for Pressure Piping, ANSI B31.1, Power Piping. The latest edition of this code covers the requirements for the fabrication assembly and erection of all other piping systems that are outside the jurisdiction of the ASME Boiler and Pressure Vessel Code Section I, Power Boilers listed above. This includes all piping and systems inside the steam plant with the exception of roof and floor drains, plumbing, sewers and sprinkler piping.

15S-03 MATERIALS

The various major piping systems are listed on the following pages with the types of pipe, valves, fittings and other materials to be used with each system.

A. Main steam and condensate within the jurisdiction of the ASME Power Boiler Code, Section I

1. Pipe 2 inch and smaller

a. Pipe - Sch. 80, Seamless Steel, ASTM A53 - 63T

b. Valves - 300 lb. screwed bronze
Gate - Crane No. 634E
Globe - Crane No. 362E
Check - Crane No. 76E

c. Fittings - 300 lb. screwed black malleable iron per ANSI B16.9-71, or 3000 lb. forged steel socket weld per ANSI B16.11-66.

2. Pipe 2½ and larger

a. Pipe - Sch 40 seamless steel per ASTM A53-63T except pipe 14 inch and larger where wall thickness shall be 0.375 inches.

b. Flanges - 300 lb. forged steel, 1/16 inch raised face. Use weld neck flanges when connecting to valves or equipment nozzles.

c. Gaskets - 1/8 inch thick spiral wound asbestos gasket, flexitallic or equal. Ring type or full face as required.

d. Valves - Boilers 1 thru 4. 250 lb. flanged cast iron, 1/16 inch raised face, bronze trim.

(1) Gate valve OS&Y, Crane No. 7½E with valves 8 inch and larger with factory installed globe valve bypass.

(2) Non-return valve - Lunkenheimer Angle - globe type Fig. 1408. OS&Y with hammer-blow hand wheel.

(3) Globe valve - Crane No. 21E OS&Y

(4) Bolts - Square head machine bolts and heavy semi-finished hex nuts, per ASTM A307 Grade B, washer to be rolled or forged steel.

e. Valves - boiler 5 & 6, 300 lb. flanged, cast steel body

(1) Gate valve - OS&Y, Crane No. 33 X U, solid disc with valves 8 inch and larger with factory installed globe valve bypass.

(2) Non-return valve - Powell Angle-Globe Type, Fig. 3086 OS&Y, plug type disc with hammer-blow handwheel.

(3) Globe valve - Crane no. 151-XR OS&Y

(4) Bolts - Alloy steel stud bolts per ASTM A193 Gr. B7 and heavy, semifinished hex nuts per ASTM A194 Gr. 2H. Washers to be rolled or forged steel.

f. Welding fittings - standard weight wrought carbon steel per ASTM A234 and ANSI B16.9 butt-weld type.

B. Miscellaneous Systems

Feedwater from deaerator connection to boiler connection
Boiler bottom blow-off to blow-off sump
Chemical feed piping from feed pump to connection on boiler or piping

1. Pipe 2 inch and smaller

a. Pipe - Sch. 80 seamless steel, ASTM A53-63T

b. Valves - 600 lb., cast or forged steel, screwed.

(1) Gate valve - Crane No. 3607 X U, OS&Y

(2) Globe - Crane No. 3640 XW, OS&Y

(3) Check - Crane No. 3694 X

c. Fittings - 3000 lb. forged steel, socket weld per ANSI B16.11-66. or extra strong carbon steel, butt weld type per ASTM A234 and ANSI B16.9 - 71.

2. Pipe 2½ inch and larger

a. Feedwater system from deaerator to boiler connection.

(1) Pipe - Sch. 40 seamless steel, per ASTM A53-63T.

(2) Valves - Boilers 1 thru 4, 250 lb. flanged cast iron 1/16 inch raised face, bronze trim.

(a) Gate valve - Crane No. 7½ E OS&Y, solid wedge disc

(b) Globe valve - Crane No. 21E OS&Y

(c) Check valve - Crane No. 31E swing check

(d) Bolting - Square head machine bolts and heavy semi-finished hex nuts, per ASTM A-307 Grade B, washer to be rolled or forged steel

(3) Valves - Boilers 5 and 6.
300 lb. flanged cast steel body

(a) Gate valve - Crane No. 33XU, OS&Y

(b) Globe valve - Crane No. 151-XR OS&Y

(c) Check valve - Crane No. 159-X swing check

(d) Bolting - Alloy steel stud bolts per ASTM A-193 Grade B7 and heavy semi-finished hex nuts per ASTM A-194 grade 2H, washers to be rolled or forged steel.

(4) Flanges - 300 lb. forged steel, 1/16 raised face, use weld neck flanges when connecting to valves or equipment nozzles

(5) Welding fittings - Standard weight carbon steel, butt-weld type per ASTM A234 and ANSI B16.9-71.

(6) Gaskets - 1/16 inch thick asbestos composition ring gasket per ANSI B16.21-62 except full face gaskets shall be used with flat-faced flanges.

b. Boiler Bottom Blowoff System from Boiler to Sump

(1) Pipe

(a) 2 inch and smaller, Sch. 80 seamless steel.
Per ASTM A53 Grade A, plain ends.

(b) 2½ inch and larger, Sch. 80 seamless steel per ASTM A53 Grade A, beveled for welding

(2) Fittings

(a) 2 inch and smaller, 3000 lb. forged steel, socket weld, per ANSI B16.11-66.

(b) 2½ inch and larger, extra strong carbon steel butt weld, per ASTM A-234 and ANSI B16.9-71.

(3) Flanges

(a) 2 inch and smaller, 300 lb. 1/16 inch raised face forged steel socket weld type per ANSI B16.5-68 and ASTM A181 Class I.

(b) 2½ inches and larger 300 lb. 1/16 inch raised face forged steel slip-on type per ANSI B16.5-68 and ASTM A181 Class I.

(4) Gaskets - 1/16 inch thick asbestos composition ring gasket per ANSI B16.21-62.

(5) Valves - There shall not be any valves installed in the blowoff piping except the two supplies with the boiler.

C. Systems not under the boiler code including:

High pressure steam and condensate
Low pressure steam and condensate
Water column drain
Continuous blowoff

Economizer vent and drain
Blowoff pit vent
Safety valve outlet
Atomizing steam
Steam sample
Miscellaneous not otherwise covered

1. Pipe

   a. 1-1/2 Inches and Smaller: Sch. 80 seamless steel per ASTM A53 Grade A.

   b. 2 Inches and Larger: Sch. 40 seamless steel per ASTM A53 Grade A, beveled for welding.

2. Fittings

   a. 1-1/2 Inches and Smaller: 300 lb. screwed black malleable iron, per ANSI B16.9-71 or 3000 lb. forged steel socket weld per ANSI B16.11-66.

   b. 2 Inches and Larger: Sch. 40 carbon steel butt-weld, per ASTM A-234 and ANSI B16.9-71.

3. Valves

   a. 2 Inches and Smaller shall be 300 lb. screwed bronze

      (1) Gate - Crane No. 634 E

      (2) Globe - Crane No. 362 E

      (3) Check - Crane No. 76 E

   b. 2-1/2 Inches and Larger shall be 150 lb. flanged, cast steel body.

      (1) Gate--OS&Y, Jenkins #1009, Crane #47, Powell #1053, valves 8" and larger shall have factory-installed globe valve bypass.

      (2) Globe--Powell No. 1531 FE, OS&Y

      (3) Check--Powell No. 1561A FE, Swing Check, Bolted Cap

4. Flanges - 150 lb. 1/16 inch raised face, per ANSI B16.5-68 and ASTM A181 Class I. Use weld neck flanges when attaching to valves or equipment.

5. Gaskets - Steam piping shall have 1/8 inch thick spiral wound asbestos ring gasket, flexitallic or equal. All others shall have 1/16 inch thick asbestos composition ring gaskets.

6. Square head machine bolts and heavy semi-finished hex nuts, per ASTM A-307 Grade B. Washer to be rolled or forged steel.

D. Systems not under the boiler code including:

Condensate return

Condensate transfer
Deaerator overflow and drain
Service water
Treated water
Diesel engine cooling water

1. Pipe

   a. 2 inches and smaller. Sch. 40, black steel, furnace butt welded per ASTM A120-63T threaded and coupled.

   b. 2½ inches and larger. Sch. 40 black steel, furnace butt welded per ASTM A120-63T beveled for welding.

2. Fittings

   a. 2 inches and smaller. 150 lb. screwed black malleable iron per ANSI B16.3-71.

   b. 2½ inches and larger, Sch. 40 carbon steel butt-weld, per ASTM A-234 and ANSI B16.9-71.

3. Valves

   a. 2 inch and smaller

      (1) Gate - 200 lb. WOG, 125 PSI steam working pressure Crane No. 430 UB, Powell No. 500S

      (2) Globe - 200 lb. WOG, 125 PSI steam working pressure screwed bronze Crane No. 212 P.

      (3) Check - 200 lb. WOG, 125 PSI steam working pressure screwed bronze swing check, Crane No. 36, Powell No. 578.

   b. 2½ inch and larger, 125 lb. flanged cast iron body.

      (1) Gate - Crane No. 465½ OS&Y

      (2) Globe - Crane No. 359

      (3) Check - Crane No. 373

4. Flanges - 150 lb. flat faced, per ANSI B16.5-68 and ASTM A181 Class I.

5. Bolting - Square head machine bolts and heavy semifinished hex nuts, per ASTM A-307 Grade B.

6. Gaskets - 1/16 inch thick asbestos composition, full face.

E. Compressed Air

Natural Gas
Liquefied petroleum gas

Fuel oil
Diesel lubricating oil

1. Pipe

   a. 1½ inches and smaller. Sch. 40, black steel, seamless per ASTM A53-63T, threaded and coupled.

   b. 2 inches and larger. Sch. 40, black steel, seamless per ASTM A53-63T, beveled for welding.

2. Fittings

   a. 1½ inches and smaller

      (1) Oil - 2000 lb. forged steel socked weld per ANSI 16.11-66.

      (2) Air and gasses - 150 lb. screwed black malleable iron per ANSI B16.3-71.

   b. 2 inches and larger, standard weight carbon steel, butt-weld, per ASTM A-234 and ANSI B16.9-71.

3. Valves

   a. 1½ inches and smaller

      (1) Gate valve - 200 lbs. WOG screwed bronze Powell No. 500S.

      (2) Globe valve - 200 lb. WOG screwed bronze, Powell No. 650. Integral seats.

      (3) Check valve - 200 lb. WOG screwed bronze swing check, Powell No. 578.

      (4) Plug valve - 200 lb. WOG. screwed iron body, lubricated plug, Homestead Fig. 601.

   b. 2 inches and larger. 125 lb. flanged, cast iron body.

      (1) Gate valve - OS&Y, solid wedge, bronze trim, bronze stem, Powell Fig. 1792.

      (2) Check valve - swing check bronze trim, Powell Fig. 559.

      (3) Plug valve - lubricated plug, Homestead Fig. 602.

4. Flanges - 150 lb. carbon steel, flat faced, per ANSI B16.5l-68 and ASTM 181 Class I.

5. Bolting - Square head machine bolts and heavy semi-finished hex nuts, per ASTM, per ASTM A-307 Grade B.

6. Gaskets - 1/16 inch thick asbestos compositions ring gasket per ANSI 16.21-62.

15S-04 EQUIPMENT

All major items of equipment required for installation on this contract shall be as specified on the applicable contract drawings and shall be furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory operating system.

A. Thermometers and Test Wells: Thermometers shall be Econ-O-Therm Series, industrial type, as manufactured by H. O. Trerice Co., or approved equal. Thermometers shall be provided with glass, red reading mercury column, V-shaped, either straight or angular pattern as conditions under which they are to be installed require for proper reading, and shall be provided with stems, as required by their location in the piping system. Thermometers shall be provided with expansion heads as required so that thermometer will not break under extremes of temperature. Each thermometer shall be provided with a separable socket well which shall be placed in the piping system. The well shall be the length required for accurate reading of the thermometer. Where thermometers occur in the insulated piping systems, or on insulated equipment, extension necks shall be provided so that the thermometer casing will be outside of the insulation. Thermometer test wells shall be equal to Trerice test well with stainless steel socket, plug and chain, and of proper length for the pipe in which it is installed.

B. Gauges. Gauges shall be provided before and after each pump and when shown, and shall be equal to H. O. Trerice Company No. 800, 4½ inch face, phosphor bronze bourdon tube, flangeless drawn steel case with black ring, brass 1/2 inch N.P.T. bottom connection, range as shown on the drawings. All gauges shall be installed using a 1/4 inch brass shut-off valve and with a 1/4 inch brass plugged test tee between the valve and gauge. When used on steam, a coil syphon equal to Trerice No. 885 shall be installed between the valve and the gauge.

15S-05 PIPING INSTALLATION.

A. General: Plumbing installation shall be coordinated with respect to space available with heating, ventilating and electrical installation. In every instance where there is a conflict in the routing of the piping and the ducting, the routing of the ducting shall govern. Installed piping shall not interfere with the operation or accessability of doors or windows; shall not encroach on aisles, passageways, and equipment; and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping above ground shall run parallel with the lines of the building unless otherwise noted on the drawings. Unless otherwise noted on the drawings, horizontal piping shall pitch down in the direction of flow with grade of not less than 1 inch in 40 feet. Piping connections to equipment shall be in accordance with details shown on the drawings. Service pipe, valves, and fittings shall be kept a sufficient distance from other work, and not less than 1/2 inch between finished covering on the different services.

B. Reducers: Reduction in pipe sizes shall be made with one-piece reducing fittings.

C. Unions: All piping unions shall be of the ground joint type constructed from materials equivalent in alloy composition and strength to other fittings specified with which they are used. Union pressure classes and end connections shall be the same as the fittings used in the lines with the unions. Steel unions shall have hardened stainless steel seating surfaces on both faces.

D. Installation of Valves: Valves shall be installed at the locations shown on the drawings and where specified. Gate valves shall be used unless otherwise shown, specified, or directed. All valves shall be installed with their stems horizontal or above. Where tight shutoff is required, a composition seat globe valve or resilient seat ball valve shall be used.

E. Pipe Hangers: Unless otherwise noted on the drawings, horizontal overhead runs of pipe shall be hung with adjustable wrought-iron or malleable-iron pipe hangers, spaced not over 8 feet apart. Tubing shall have hangers spaced not over 5 feet apart. Chain strap, perforated bar or wire hangers will not be permitted. Trapeze hangers may be used in lieu of separate hangars on pipes running parallel to each other and close together. All hangers shall have short turnbuckles or other approved means of adjustment, and should be suspended from structural members. Hangers and collars shall be of a size proportionate to the weight of the pipe supported.

F. Equipment Connections: All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment. The Contractor shall be required as directed to remove the bolts in flanged connections or disconnect piping to demonstrate that the piping has been so connected. Pipe connections to equipment shall be made with unions or flanged fittings.

G. Joints:

1. Flanged Joints: All flanged joints shall be face matched. Raised face flanges shall not be mated to flat-faced cast-iron flanges. The raised face must be turned off.

2. Screwed Joints: Screwed pipe joints shall have American Standard Taper Pipe Threads (ASA-B2.1). Burrs formed when cutting pipe shall be removed by reaming. Care shall be taken that the inside of pipe is thoroughly clean and free of cutting oil and foreign matter before installation. Joints shall be made perfectly tight by the use of Teflon tape or approved Teflon thread sealing and lubricating compound.

3. Welded Joints: Joints between sections of pipe and between pipe and fittings 1-1/2 inches and larger may be welded using either gas or electric welding equipment. All pipe surfaces shall be thoroughly cleaned before welding. Each joint, except socket-weld joints, shall be beveled before being welded. The Contractor shall provide an asbestos mat or blanket to protect the structure and adequate fire protection equipment at all locations where welding is done. All elbows shall be long radius where space conditions allow. Wherever tee connections are made to piping systems on the main run, welding sockets or weldolets may be used in lieu of reducing outlet tees for branch connections up to one-half the size of the main run. On connections larger than one-half the size of the main run, welding tees shall be used. The use of fittings formed from welding shall be per "General Material and Work Requirements, Mechanical" section of these Specifications.

15S-06 TESTS

A. General: Before insulation is applied, all piping, equipment, and accessories installed under this contract shall be inspected and tested by the Contractor in the presence of the Sandia Laboratories' Delegated Representative, and approved before acceptance. All labor, material, and equipment required for testing shall be furnished by the Contractor. The Contractor shall be responsible for all repairs and retesting as required. All instruments and other equipment whose safe pressure range is below that of the test pressure shall be removed from the line or blanked off before applying the tests. Prior to performing tests, all lines shall be "blown" free of all loose dirt and foreign particles. The lines shall then be thoroughly flushed with water (liquid lines only) or compressed air (for gas lines) at a sufficient flow rate and period of time through a full-size fitting, to insure complete cleansing of the line of all dirt, scale, and foreign matter. Satisfactory cleaning and flushing of the lines shall be subject to the approval of the Sandia Laboratories' Delegated Representative. After testing and flushing lines, all filters and strainers shall be cleaned.

B. Testing: Piping shall be tested using compressed air or water for water systems and shall show no drop in pressure in a two-hour period. Tests shall be performed in accordance with the following schedule:

System		Pressure
Under the Boiler Code		
Steam	Boilers 1 thru 4	240
	Boilers 5 & 6	375
Feedwater and Blowoff		
	Boilers 1 thru 4	300
	Boilers 5 & 6	475
Not under the Boiler Code		
Steam and Condensate		175
Continuous Blowoff		175
Atomizing Steam		175
Steam Sample		175

System		Pressure
Feedwater Pump Disch.		
	Boilers 1 thru 4	300
	Boilers 5 & 6	475
	Condensate Return	190
	Condensate Transfer	190
	Feedwater Pump Suction	190
	Low Pressure Steam	150
	Service Water	190
	Treated Water	190
	Cooling Water	190
	Natural Gas	200
	Propane Gas	200
	Fuel Oil	225
	Diesel Oil	225

All systems not identified shall be tested to 1½ times the design working pressure.